Final Report – April 2011

Alternatives *to* 1080 Program

A Summary of Research, Extension and Demonstration Activities Funded and Undertaken under the Alternatives to 1080 Program

Australian Government

Tasmania

CONTENTS

1. EXECUTIVE SUMMARY

This report provides a summary of the research, extension and demonstration activities undertaken through the Alternatives to 1080 Program.

The Alternatives to 1080 Program (the Program) was established as part of the Tasmanian Community Forest Agreement to accelerate research into, and implementation of, alternative strategies for control of browsing damage by wildlife on private forest and agricultural lands. The Program was a partnership between the Australian and Tasmanian governments.

The Program has successfully advanced our understanding of the more promising alternative browsing damage control options, including an improved understanding of the potential for specialised shooting equipment such as thermal scopes and silencers, new trap designs and trapping approaches, developments to improve the cost effectiveness of seedling stockings, evaluation of several potential repellents, improvements in wildlife-proof fencing including the development of new wombat gates and wallaby grids, and an alternative and potentially more humane poison, Feratox®.

Critically, the Program has highlighted the extent of production losses in agricultural and forest plantation areas from wildlife browsing. It has shown that to be effective at reducing crop or pasture losses, any control strategy must effectively reduce and then maintain very low wildlife numbers on the crop or pasture area over time, and must target those areas where the highest levels of damage are being experienced.

Program research suggests that much of the control effort currently undertaken in Tasmania is not achieving these objectives, and in fact it suggests that any control strategy that relies on just one control option is unlikely to be effective due to the diminishing effectiveness of any single control tool as population levels decrease and learned avoidance behaviour increases, or in the case of fencing, its diminishing effectiveness at higher population levels.

The Program has identified that the most effective control strategies are likely to be those which use a combination of controls, particularly those that combine effective wallaby proof fencing with best practice shooting, trapping or poisoning and which use effective pasture or crop monitoring techniques to monitor the success of the program. The Program has also shown that these strategies can be cost effective in reducing crop damage and pasture loss by browsing animals if implemented effectively.

Monitoring wildlife numbers using spotlight counts, or the numbers of wildlife shot, have both been demonstrated to be very ineffective tools for evaluating the effectiveness of a control strategy.

Findings from the Program have clearly shown that most landowners don't consider wildlife management to be a core part of their businesses, but rather something that has been forced on them that has consequences financially and impacts on their viability. For many the current control strategy they use is not an active choice, but rather a matter of doing what seems possible.

Most landowners also question why they have to bear the cost of wildlife coming onto their properties and damaging their crops and pastures, particularly where they border onto Government owned land.

A significant issue for landholders is that the cost and level of effort required to implement an effective control strategy is high, and most landholders aren't willing or able to fund the up-front costs of implementing strategies, particularly fencing strategies. The sustained level of effort required to effectively control browsing is also an issue for landholders, particularly given that the benefits of implementing control strategies is often uncertain.

While there are more areas that would benefit from further research, findings from the program suggest that extension efforts to help landowners more effectively utilise those tools that are already available would be a higher priority, particularly as research suggests that wildlife browsing control is often an underdeveloped aspect of property management.

In conclusion, the Program identified a need for planning and financial analysis tools as well as the integration of browsing wildlife management into farm planning practices to move more landholders away from reactionary control efforts to a strategic and well planned process in which the outcomes are monitored and fed back into the planning process. The Program also found that there were a number of barriers to landholders adopting new and improved browsing management practices, including a lack of information, lack of financial resources and a lack of time.

2. BACKGROUND

The Alternatives to 1080 Program (the Program) was established under clause 39 of the *Tasmanian Community Forest Agreement* (TCFA) to accelerate research into, and implementation of, alternative strategies for control of damage by browsing wildlife on private forests and agricultural lands. Four million dollars was allocated by the Australian Government under the TCFA to fund the Program that was managed by the Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE).

An initial review by Landcare Research, New Zealand of possible alternatives to use of 1080 poison, conducted in 2006, identified that there were no obvious, or even apparent, alternatives to replace 1080 poison for control of browsing damage by mammals in Tasmania. This led to a *Strategic Plan* that focused on improving the understanding of the significance of wildlife browsing damage and on investigating a wide range of alternatives identified as having short to medium term potential as viable and competitive alternatives to the use of 1080 poison.

The Program's primary funding mechanism was through targeted grants. $2.4million was invested in 19 external research projects with each receiving funding ranging from $27,000 to $400,000. This funding was offered over four separate rounds of competitive grants.

In addition, $0.8m was invested in a program of research and demonstration work, undertaken by project officers working within DPIPWE. This work primarily focused on shooting and trapping as alternatives to 1080, but worked with researchers and stakeholders in a wide range of areas.

A further $0.4m was invested in a joint program with the Tasmanian Institute of Agricultural Research's (TIAR) extensive agriculture group looking at fencing, browsing behaviour, repellents, seedling stockings and Feratox® as alternatives to 1080 poison.

A further $0.4m was invested in program management.

The Program was limited in the research that could be designed and accomplished given the available time-frame of four years, especially given the large lead time required to review and gain stakeholder support for the *Strategic Plan*, the need to establish the governance structure for the different parts of the program and the considerable communication program that was run for stakeholders and the public via field demonstrations, workshops and other forms of written and spoken extension.

Given the above constraints it is important to have realistic expectations of the Program. The Tasmanian wildlife browsing problem is neither new nor simple and has become more complex with the increased fragmentation of the Tasmanian landscape and increasing community concerns regarding animal welfare and the use of toxins. The research work had to be primarily field-based and carried out on ecosystems highly variable in both time and space. It also had to satisfy strict requirements imposed by Animal Ethics Committees established under the *Animal Welfare Act 1993* to oversee research activities. In some cases this restricted the extent of the work. Finally the target species themselves are nocturnal and their ecology and behaviour are still far from fully understood. It is a testament to the researchers and project officers that despite these limitations, such a broad range of projects were able to be successfully undertaken.

The effect of any potential control method on the welfare of the browsing animals was a critical consideration in assessing the acceptability of different methods, and the *model for assessing the relative humaneness of pest animal control methods* developed by the NSW Department of Primary Industries' Vertebrate Pest Research Unit was used to evaluate the different control alternatives examined.

This report summarises a large number of published and unpublished reports, workshop proceedings and conference presentations generated by the Program. These reports are listed in the biography of this report and are available by going to www.dpipwe.tas.gov.au.

For simplicity in this report 'browsing' is used to encompass grazing as well.

3. WILDLIFE BROWSING IMPACTS

The basis of modern vertebrate pest management requires an understanding of the relationship between pest animals and the damage they cause to pastures, crops and plantations. In the case of the damage caused by Tasmanian pademelons, Bennetts wallabies and brushtail possums in Tasmania, this means an understanding of the many factors that determine the impacts of our wildlife on pastures, crops and plantations, and the effectiveness of different control options in reducing this damage.

Increasing our understanding of this relationship was a key priority for the Program, and the work undertaken has clearly shown that the current level of browsing by wildlife on pastures and crops is having a very significant impact on farm viability and plantation survival.

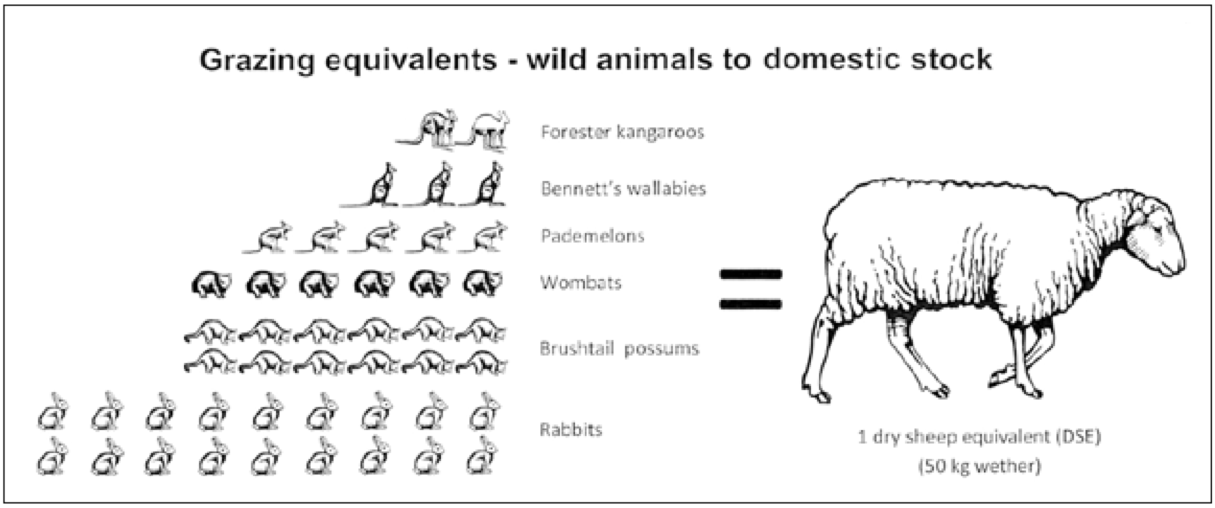


Figure 1: Grazing equivalents for wild animals to domestic stock. *(Illustration by Bruce Dolbey.)*

A key outcome of the Program has been the development of the BITE© model which allows individual land managers to estimate the financial impact that browsing by wildlife is having on their business and thereby allows them to make informed decisions on adopting various options for managing this damage.

The Programs work also confirmed the concerns raised by those stakeholders experiencing browsing impacts that current control efforts are frequently not effective in controlling these losses.

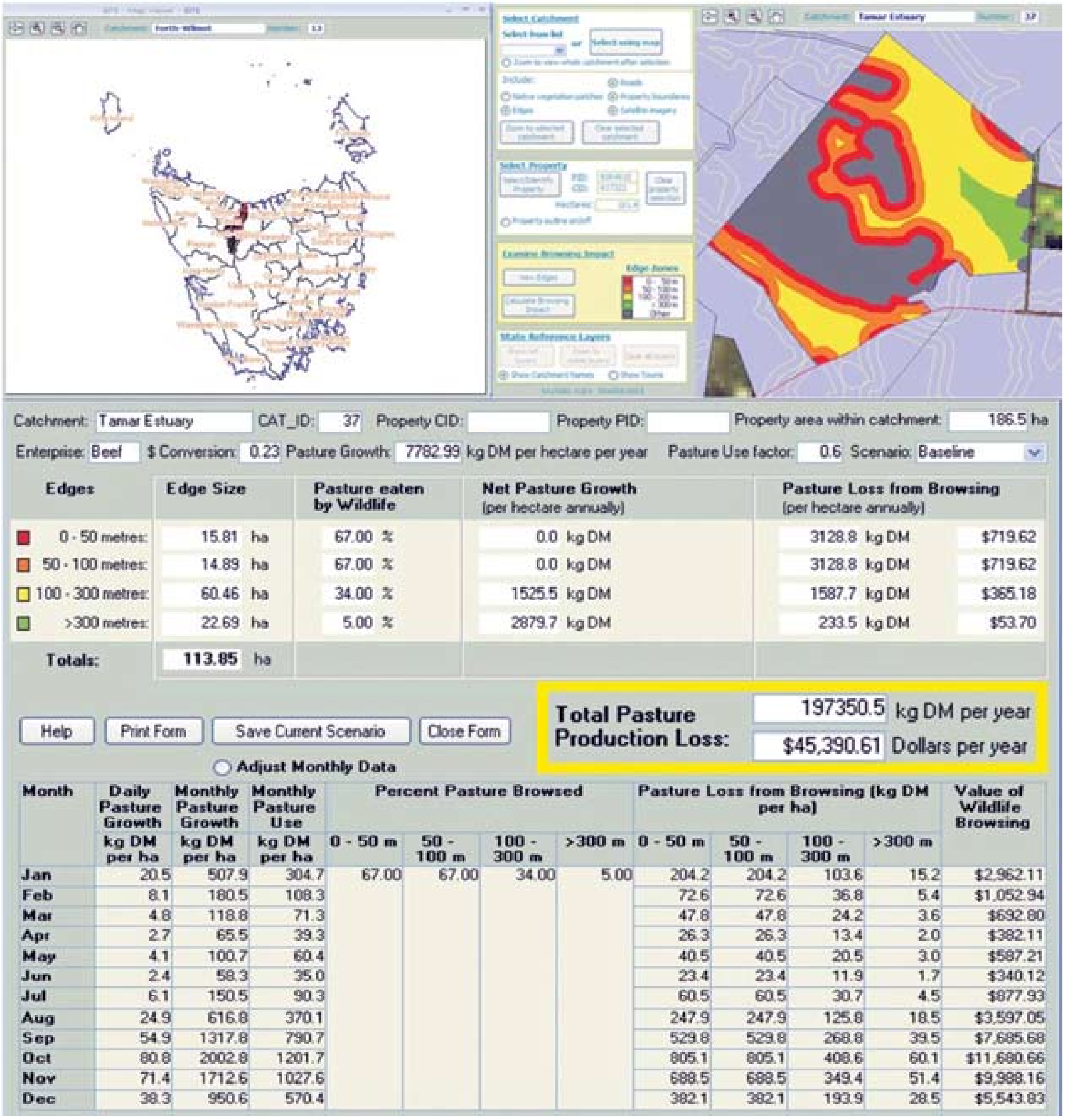


Figure 2: BITE is a powerful computer software program that can help landowners estimate their pasture loss.

3.1 Perceptions of Wildlife Impacts

3.1(a) Agricultural Landowners

At a field day in 2008, one of the local farmers present was queried about the effectiveness of his shooting strategy. After a few moments consideration he replied that he didn't know exactly how effective it was, but at least it made him feel better doing something about the problem.

Another landholder contacted the Wildlife Management Branch seeking help with managing his pasture losses to the wildlife on his farm. A professional game controller visited the site and ended up offering to shoot the property for free, with the only condition being that the landholder's families and friends, who also shot on the property, ceased their shooting activities for a few months whilst he got the problem under control. The landholder declined the offer, as he didn't want to upset his current shooters despite the fact they obviously weren't providing the wildlife damage control needed.

These two examples underline the importance in understanding the drivers behind landholder decision making, because the control strategies in place on properties did not evolve in a vacuum and were often driven by more than just the objective of reducing pasture or crop losses. Because of this, landholders will not necessarily just change their management because new information or knowledge comes along.

Funding was provided to Rural Development Services (RDS) in 2007 to examine landholder perceptions of wildlife browsing in the agricultural sector in Tasmania, and particularly the use of 1080 poison. This research provides an important social overlay on decision making for the more scientific aspects of the program, and is worth reviewing before looking at actual impacts and control options provided by the Program.

In interpreting RDS's work, it is important to note that the original survey was drawn from farmers who had used 1080 poison in the previous 10 years, so was deliberately biased towards landholders who had a wildlife browsing problem. The follow up survey did however include a portion of respondents who did not use 1080 poison.

As expected given the survey pool, RDS's work found that 98% of landholder respondents believed that wildlife browsing damage affected their total farm income through productivity loss, with 74% of landholders surveyed indicating that managing browsing wildlife impacts was a very important priority for their property.

Landholder estimates of the percentage reduction in farm productivity in the financial year 2006-07 as a result of browsing wildlife damage varied widely, but the average estimated reduction was 22.4%, which, if representative of all landholders, is a significant impact on farm and State productivity given that Australian Bureau of Statistics figures for 2006-07 valued the gross value of Tasmania's agricultural sector at $963m.

Looking at the use of different control options, respondents were asked to rank the importance of the different control options they use on a scale of one (least important) to five (most important). Shooting/hunting was identified as the most important control tool being used by respondents (3.9) followed fairly closely by 1080 poison (3.4) and fencing (3.2). Despite the high ranking given to 1080 poison, 45% of respondents thought their last 1080 poison operation had been effective for three months or less, and 63% thought it had been effective for less than one year. Only 13% of respondents thought their last 1080 poison was effective for three or more years (the minimum time now specified between 1080 poisonings under the code of practice for use of 1080 poison).

A little over half (55%) said that they had wanted to, or attempted to, use 1080 poison again since their last poison and 45% said they hadn't. About half of the landholders indicated that there were multiple reasons why they hadn't used 1080 poison again; with the most common reason being that it was ‘too hard to get’. The next most common reasons for not using 1080 poison again were ‘expense’ and ‘concern about neighbour issues, including farm dogs’.

Shooting /hunting was identified as the most important control option by landholders, and this is supported by DPIPWE crop protection figures for 2006-07 which show there were around 2,000 properties in Tasmania with permits allowing the shooting of wallaby and possum for crop protection purposes. Based on ABS figures of 3,478 agricultural enterprises in Tasmania as at 30 June 2007, this represents well over half of all agricultural enterprises in Tasmania.

DPIPWE estimates also show that over one million wallabies and four hundred thousand possums were culled under these permits for crop protection purposes in 2006-07, a 50% increase in numbers since 2000-01 when the *Tasmania Together* Targets for phasing out the use of 1080 poison for native browsing animal control by 2015 was set. Yet, despite this increased level of culling, RDS’s survey found that only 12% of respondents felt that their shooting effort provided satisfactory control, with the other 88% of respondents reporting it as providing only ‘somewhat satisfactory’ or ‘no control effectiveness’.

The most common method by which landholders assessed the effectiveness of their shooting program was by the number of animals shot, although observations of fewer animals and of less damage to crops were also regarded as important. Commonly two or more methods were used together.

Fencing was the least commonly used of the three controls, although over half (54 %) of respondents to the survey had constructed special wallaby proof fencing. Fencing was reported to be the most effective control by those who had used it, with almost half of landholders with wallaby fencing rating it as either completely effective or as providing a satisfactory level of effectiveness.

Only 8% thought that fencing did not work at all and 46% indicated that it was somewhat satisfactory. Landholders were asked why they hadn’t used wallaby proof fencing and were able to elect more than one reason. The most common response was ‘construction costs’ followed by ‘inappropriate terrain’. Concern about maintenance costs was also significant.

SUMMARY

In summarising their findings, RDS noted the complex environment in which landholder decisions were being made. Based on this work RDS identified the need for planning tools, financial analysis tools, and integration of wildlife management into whole farm planning as key approaches to move more farmers away from reactionary or ongoing control, to integrated based control strategies. They also identified the need for extension efforts in this area to help landowners make this transition.

3.1(b) Forestry Sector

At the commencement of the Alternatives to 1080 Program in 2006, Managed Investment Scheme (MIS) plantation forestry was near its peak, and the issue of wildlife damage on new plantations was driving the bulk of 1080 poison use in the private forestry sector.

Farmers were leasing or selling parts of their farms that had become marginal for agricultural purposes to forest companies. Forest management companies were spending millions of dollars on wildlife control as they planted these areas.

Shooting was providing a degree of browsing protection for these companies, but with some catastrophic losses being experienced despite the large cost and effort being employed. Fencing construction and maintenance was problematic in plantations, and trapping, seedling stockings and nursery techniques such as hardening seedlings were still all in their infancy.

In this environment, and with few other controls available to them, the companies argued strongly for the need to maintain access to the use of 1080 poison as a tool of last resort until viable alternatives could be developed.

By June 2010, just after the completion of the Program, Gunns Limited announced the immediate cessation of 1080 use because they believed there were enough alternatives in place to control browsing damage. The use of 1080 poison in public forests had ceased in 2005.

Gunn's decision, alongside the 'collapse' of the MIS sector in 2010 now means that the use of 1080 poison in the industrial forestry sector in Tasmania has for all practical purposes ceased.

3.2 Pasture Losses

The Program funded a group within the Tasmanian Institute of Agricultural Research (TIAR), led by Prof. Tony Norton, to undertake several projects to quantify pasture losses to wildlife in different regions of mainland Tasmania and on King Island. Trials undertaken in these projects all showed a significant impact from native wildlife browsing on farm productivity.

On average, across the trial sites in the north east and north west of the State, over 70% of pasture growth was being lost to wildlife browsing at the bush edge, and even 100 metres from the bush edge losses to wildlife browsing were still around 57% for dryland sites and 40% for irrigated sites. These were often sites where some form of wildlife control in the form of shooting or fencing was in place.

Figure 3: Pasture monitoring using exclosure plots on a dryland sheep grazing site in the Tasmanian midlands.

Monitoring was not carried out past 100 metres for these trials, but a second project on a dryland sheep grazing site in the Tasmanian Midlands monitored pasture losses out to 800m from the bush edge to also pick up on the impacts of forester kangaroos. This trial demonstrated that wildlife browsing impacts commonly extends out to 300 metres, and in the winter of 2008 monitoring at this site showed that the landholder was losing 68% of pasture growth to wildlife grazing 800m from the bush edge, the maximum measuring point recorded.

Similar work on King Island found the average loss of pasture across all the monitored sites ranged between 43% and 28% respectively at 10m and 100m from the bush line. Based on this research it was estimated that the total annual pasture loss to wildlife browsing on King Island could be up to 82,687 tonnes of dry matter, or 1.2 tonnes of dry matter per ha. In dollar terms this was around $436 per hectare for a beef enterprise, $164 per hectare for sheep or $664 per hectare for a dairy enterprise.

These results are broadly in line with previous studies carried out on pasture losses to wildlife browsing, but are still only a small sample for drawing conclusions for the whole of Tasmania.

Financial modelling done by the Program, based on the relationship between distance from bush edge and browsing losses determined in these studies, has shown that the bulk of a farm's losses are likely to occur in the first 100 metres from the bush edge, and certainly within the first 300 metres.

A theoretical 100ha (1km x 1km) farm was modelled which had a single 1km bush edge. This property would only have 10% of the property area in the high browse area (0-100m), 20% in the medium browse (100-300m) and 70% of the property in the low browse areas (300m+). However 40% of production losses would occur in the 10% of the property in the high browse margin on the bush edge, and 80% in the high and medium area combined, despite this being only 30% of the total land area.

With approximately 25% of agricultural land in Tasmania within this high browse zone (100 metres from a vegetation or creek boundary), and with a further 24% in the medium browsing zone of 100 – 300 metres, landholder estimates of 22% productivity losses do not seem unreasonable, and if anything, these studies suggest that landholders are underestimating their losses to wildlife browsing.

The implications of these pasture loss studies are that control efforts are most likely to provide financial benefits if they can protect the pasture area adjacent to the bush margin, which may in part explain the perceptions found in the RDS survey regarding the relative effectiveness of fencing over shooting strategies, because well erected and maintained fencing is likely to be far more effective in protecting this bush edge area and thus increasing overall farm productivity.

Looking at this from a different perspective, in his work on the suitability of performance based controls in Tasmania, Dr Bruce Warburton of Landcare Research noted that the relationship between pest density and damage isn't usually linear. The relationship is much more likely to be either upward or downward convex (Curves A or C in Figure 4). Curve A represents a relationship where the benefits, in terms of reduced impacts, will accrue only if the density of the browsing species is reduced to very low levels, in this example less than about 2 pests ha^{-1}. Consequently, any funds expended on control that does not achieve at least that reduction in pest numbers are wasted. Conversely, if the relationship is closer to curve C, then most of the benefits can be achieved by reducing the density to around 8 pests ha^{-1}, and efforts to reduce pest density below this level would provide no real benefits to the landholder.

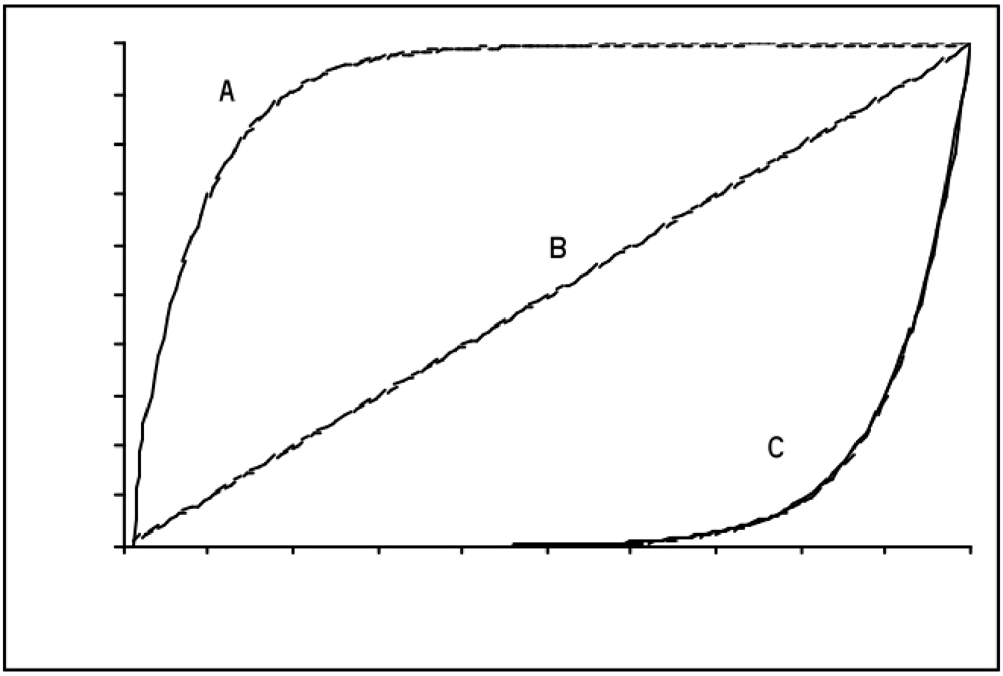


Figure 4: Possible theoretical relationships between pest density and impact, take from Warburton & Cowan (2008), Contract-based systems for controlling browsing mammal pests in Tasmania.

It can be seen that knowledge of this relationship is a critical part of understanding what needs to be done to implement effective wildlife damage control as it defines what reductions in local pest animal populations will achieve in terms of financial benefits to the landholder.

The topography on King Island made it one of the few places in Tasmania where reasonably accurate wildlife densities can be determined on pasture areas, and so a project was funded on the island to in part determine which of these relationships best describes the relationship between Bennett's wallaby density and pasture losses.

Figure 5: An aerial shot of King Island.

The results of this study (Figure 6) indicated that high levels of pasture loss occurred even at what would be considered to be very low levels of wallaby density anywhere in Tasmania, with the marginal impact of each additional animal beyond this level having an ever decreasing impact on pasture loss. This relationship is best represented by curve A in Figure 4 and implies that unless control efforts achieve a reduction in wallaby numbers to very low numbers, the control effort will still be largely ineffective in reducing impacts. It also implies that using the numbers of wildlife culled, one of the two most commonly used measures of control effectiveness reported in RDS's survey, isn't a useful method for measuring control effectiveness. It is the wildlife numbers remaining and ultimately the impact of browsing on pasture production that is critical.

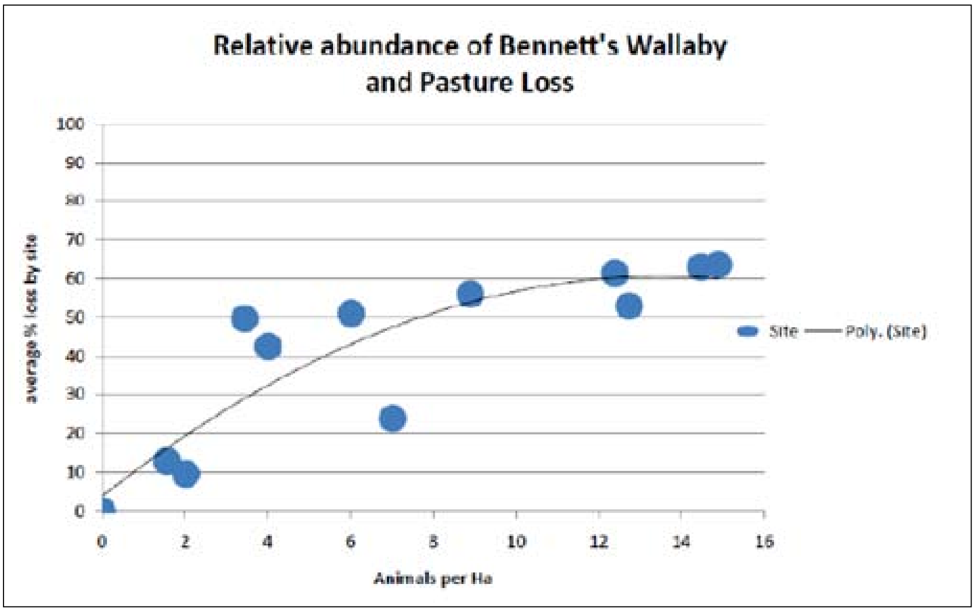


Figure 6: Relationship between the relative abundance of Bennett's Wallaby (animals ha^{-1}) and average % pasture loss to wildlife browsing on King Island; data for all 12 sites combined and assuming the curve arises from the origin – an x/y intercept of zero.

The Program also looked at the effectiveness of using night-time spotlight counts in estimating local wildlife abundance and hence pasture impacts, as this was reported in the RDS survey as the other most commonly used method for estimating control effectiveness by landholders. This work found that animal counts were an unreliable and inaccurate way of measuring both wildlife abundance and, more importantly, their impacts.

SUMMARY

Whilst recognising that further research to confirm the Program's findings is highly desirable, the research from the Program has confirmed that wildlife browsing impacts are very significant and probably more significant than many landholders, particularly those with crops or pasture where it is difficult to visually assess wildlife browsing impacts, would estimate.

These studies also indicate that landholders aren't using the right monitoring tools to develop an effective wildlife management strategy as their current methods are not providing accurate information on pasture and crop losses. Directly measuring losses was found to be the only accurate way of understanding the financial costs of wildlife browsing on a property.

Figure 7: Direct pasture monitoring using exclosure plots is the best way to understand wildlife impacts. They also require the most effort.

The final key conclusion that can be drawn from these studies is that as high levels of pasture and crop losses were being recorded at sites which would be considered to have low densities in Tasmania, this implies that to be effective control strategies will need to reduce local population levels to very low levels, otherwise the effort may just be wasted.

3.3 Plantation Losses

Whilst Tasmanian pademelons and Bennetts wallabies are usually the most abundant animals seen and shot in plantations, their gut physiologies are designed to digest grasses and forbs (any herb that is not a grass or grass like) rather than eucalypt leaves, and that therefore abundance does not necessarily directly transfer through to damage.

By comparison, brushtail possum are much less frequently seen in plantations, but trapping and poisoning operations would indicate their numbers are usually much higher than would be estimated from spotlight counting, and it has been shown that their gut physiology enables them to digest a much higher dietary component of eucalypt leaves than wallabies. Combining the results from captive feeding trials and information on gut physiology suggests that brushtail possums may be the primary browser in plantations.

To examine this, one of the first trials carried out by the Program attempted to see if targeted removal of brushtail possums, while leaving wallabies unharmed, would reduce browsing damage. These trials, carried out by Forestry Tasmania, found unacceptable levels of browsing still occurring in the selectively culled coupes, indicating that wallabies were still a significant browser.

To better understand browsing behaviour and impacts, several research teams were provided with resources to examine this issue by directly monitoring wildlife browsing in plantations:

- Dr Ivo Edwards used grant funding to purchase wide area infra-red floodlights and monitoring gear and used this to monitor pademelon and possum browsing in a small plot of seedlings planted near his workshop outside Maydena.
  He found that all of the browsing damage in this small trial was caused by brushtail possums despite a high abundance of pademelons moving through, and browsing between, the seedlings. Brushtail possums usually heavily browsed several adjacent seedlings and where seedling stockings were in place, the possums would browse only the top unprotected leaves.

Figure 8: Photo still from footage of a pademelon browsing a seedling.

- Andrew Walsh of Forestry Tasmania used infra-red cameras supplied by the Program to monitor seedlings in several plantations, which had previously been heavily browsed, but he wasn't able to capture footage of any direct browsing activity during the monitoring period.

- Dr Mick Statham's team at TIAR monitored browsing in a coupe near Exeter and were able to capture footage of pademelons, but not Bennett's wallabies or brushtail possums browsing seedlings. Those few pademelons observed browsing seedlings in these trials all lightly browsed a leaf or two from individual seedlings whilst grazing or moving through the area.
- The Project Officer Program also undertook wide area monitoring of plantation browsing at the same Exeter coupe over a number of nights using infra-red floodlights and video monitoring equipment, but failed to capture footage of any direct browsing by the target species.

The main conclusion that can be drawn from these trials is that whilst potentially worthwhile, it is very difficult to directly observe browsing behaviour in the wild, with the necessary time and resources beyond that of the Program.

Dr Statham's team conducted a more detailed study of the pattern of browsing at a heavily browsed coupe near Exeter. In one trial area browsed seedlings were replaced weekly, and in a second area the browsed seedlings were not replaced. From the wildlife runs developed in the plantation and presence of faecal pellets, browsing damage over time was attributed to Bennett's wallabies and pademelons rather than possums. The damage was found to be clumped and occur in patches with animals returning to the same area to browse whether or not the seedlings were replanted.

It was concluded that *Eucalyptus nitens* seedlings are less attractive to both pademelons and Bennett's wallabies than other plant species and were eaten only when preferred species were less available. Because of this the researchers concluded that if seedlings are planted in spring a reduction in damage might be achieved during that season as it is a time when there is a plentiful supply of alternative preferred food. With autumn and early winter planting, as in this trial, the seedlings are exposed to maximum browsing pressure over the slow growing period of winter. It was also concluded that any post planting lethal control in a coupe will have maximum effect if it is concentrated where damage is occurring and hence targets those individuals actually doing the damage.

Dr Statham's team also made an examination of gut contents from several pademelons and Bennett's wallabies shot from the plantation. Leaf fragments of eucalypt seedlings were identified in gut sub-samples from one of three of the pademelons and one of the three Bennett's wallabies examined, again confirming that while all three species do browse eucalypts, they are not a preferred food source.

By combining estimated dietary intake and measured dry matter content of recently planted seedlings, Dr Statham was able to estimate that if an average Bennett's wallaby ate only eucalypt seedlings it would take 685 seedlings a day to derive its daily energy requirements, a pademelon would require 333 seedlings, and a brushtail possum would require 125 seedlings.

However gut physiology evidence and the browsing behaviour observed suggests that wallabies and pademelons tend to be only incidental browsers, it is clear that seedling consumption would be much lower than this. Taking a pragmatic viewpoint, even at very low densities of just 1 or 2 animals per hectare and assuming only a small amount (<1%) of their diet came from eucalypt seedlings, losses of around 10% of seedlings could occur in under 2 weeks which is the 'threshold' level of damage many private forestry companies expressed they were willing to accept. Beyond this level of damage, the economic viability of the plantation is at risk.

SUMMARY

These studies have shown that all three species are capable of causing significant damage to plantations in short periods of time, and that targeted control strategies aimed at a single species are likely to be ineffective at controlling browsing damage in high risk areas.

The research also highlighted the impacts that the season of planting can have on browsing damage.

4. APPROACHES TO WILDLIFE MANAGEMENT

4.1 Property Based Wildlife Management

DPIPWE uses a Property Based Wildlife Management Planning (PBWMP) framework for assisting landholders deal with both wildlife management and crop protection in Tasmania.

A PBWMP is a written agreement between a landowner and hunters that is facilitated by DPIPWE. Its purpose is to manage wildlife at levels compatible with agriculture, forestry and the environment while providing for sustainable hunting opportunities and fair compensation for the landowner. On properties with fallow deer *(Dama dama)* recreational hunters often have agreements with landowners to shoot Bennett's, pademelons and possums for several days per year as a prerequisite to hunting deer.

These plans have evolved from Game Management Plans, developed in the early 1990s, which were aimed principally at properties, which used hunting groups that wanted to undertake Quality Deer Management strategies. These plans have been expanded to incorporate broader wildlife management objectives, including management of wildlife browsing damage, and since 2006 it has been a requirement that a landholder who seeks to do a repeat 1080 poison has a DPIPWE approved property based Wildlife Management Plan operating on their property.

These plans were identified as a key vehicle for the delivery of the outcomes of the Alternatives to 1080 Program and so it was seen as important to better understand how these plans are currently used and perceived by landholders who have them, as well as look at whether catchment or sub-catchment approaches may be more appropriate scales at which to manage wallabies and brushtail possums as these species home ranges often crossed both property and land tenure boundaries.

4.2 Sub-catchment Approaches

NRM North was provided with funding to undertake a two stage project to look at a sub-catchment approach to wildlife management, using the Pyengana area in North-east Tasmania as a case study.

The first stage of this project involved a review of information collected on Property Based Wildlife Management Planning from the RDS research project into the use and non-use of 1080, as well as a number of face to face interviews with farmers in the north eastern region who had Property Based Wildlife Management Plans to see how they used these plans and what benefits and were for their properties, were perceived.

This study concluded that whilst PBWMPs may have been fit for the purpose for which they were originally intended, namely facilitating effective relationships between deer hunters and landholders, the landholders in the north eastern region did not have deer on their properties and were thus unable to attract significant numbers of recreational hunters to assist in managing their browsing wildlife populations.

None the less the PBWMP was regarded by landholders interviewed as being helpful with processes associated with managing their shooting such as the provision of information about requirements for permits; the process of documenting an approach to wildlife management and the requirement to return log books for record keeping.

The results of the survey strongly suggested that current PBWMPs were not the best tool for landholders who are looking for control options other than shooting. There was clearly some resentment from landholders who felt obliged to go through the process of preparing a PBWMP when in actuality they really just wanted access to 1080 poison.

Utilising the knowledge from the first stage, the second stage of the project involved a year long project working with about a dozen farmers in the Pyengana Valley to try a Nil Tenure Approach to the management of their wildlife problems. This approach was selected as a control method that was landscape based rather than land holder based. It considers the movement and behaviour of a species and identifies the best control options and areas for control, irrespective of land tenure boundaries.

Field days (Figure 9) were initially conducted where professional wildlife cullers and fencing experts discussed the pros and cons of the different control options, as well as visiting and discussing what specific landowners were doing in the region. To complete the process, facilitated planning days were then held to look at how best to control the wildlife browsing problems at a sub-catchment level.

At the end of this process, it was apparent that the Nil Tenure Approach was not being adopted by the landholders as each landholder perceived their wildlife problem to be specific to their property, not a shared problem with a shared solution. The only exception to this was a willingness to work with

direct neighbours when it came to erecting wallaby proof fencing along a common boundary.

However, in going through this process it became clear that the process of providing information on different control strategies, conducting field days with experts present, and discussing and viewing the control effort and problems at a sub-catchment scale greatly assisted individual landowners in reviewing their own control strategies. Furthermore, the provision of grant funding to the participants who went on and developed and implemented Property based Wildlife Management Plans within the sub-catchment framework also helped landholders over the adoption hump, with the majority participating in one or more actions to improve their wildlife management with fencing being the main control option.

Figure 9: Pyengana farmers on a field.

SUMMARY

This research project identified that whilst current PBWMPs are assisting landholders with the paperwork and permitting processes, they aren't helping landholders understand and implement better wildlife management strategies and outcomes.

The Pyengana case study demonstrated the value of providing landholders with expert knowledge and the support and resources to develop wildlife management plans and assist with implementing those plans. Many of the landholders undertook a radical change in attitude towards control options over the course of the study as they saw what other landholders were doing and had the opportunity to interact with professional shooters and fencing experts.

The project also demonstrated though that unless a third party co-ordinator comes in to support a community, ultimately landholders will focus on their properties and browsing wildlife problems, and hence property based strategies will be the predominant scale of control in Tasmania.

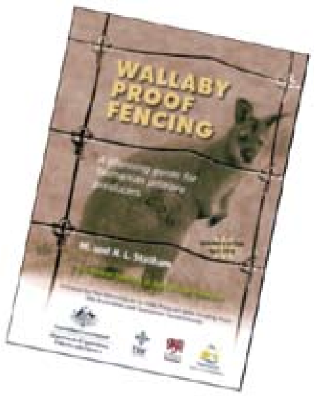
5. ALTERNATIVE CONTROL OPTIONS

5.1 Wallaby Fencing

As identified in the RDS survey, wallaby-proof fencing is regarded as the most effective strategy undertaken by landholders and, alongside improved shooting, appears to provide the greatest opportunity in the short term for more effective wildlife damage control in Tasmania. It is also the option most strongly advocated by animal welfare stakeholders.

Figure 10: An example of an eeffective wallaby proof fence.

The Program funded the production of a *Wallaby Proof Fencing Planning Guide for Tasmanian Primary Producers,* which showcases different approaches to wallaby proof fencing in Tasmania and outlines key elements and pitfalls relating to effective wallaby proof fencing. This guide has proven to be extremely popular, and has already gone into a second edition.



While fencing has a number of strengths, it is not a viable alternative to using 1080 poison for browsing wildlife control in all situations. Many farms have a mosaic of pasture and crops, bushland, forest and other native ecosystem patches where fencing is not practicable, or can concentrate wildlife damage in unfenced native vegetation or pastures. Wallaby fencing also restricts movement and dispersal of non target species.

An effective and humane fencing strategy in areas with high local population levels will require an initial population reduction and possibly ongoing wildlife removal otherwise wildlife will attempt to breach the fence.

Fencing was found to work best for higher value irrigated crops or beef and dairy enterprises with clear delineation between farmland and bushland and where there are not the complicating factors of gullies, rocky soils, wombats, public roads and creeks. Lower productivity enterprises or areas with any of these complicating factors will find it more difficult to erect and maintain effective fencing, or to indeed justify the high up-front cost of fence construction which is still one of the most significant barriers to its use.

Landholders who share boundaries with Crown land also have to pay the full cost of fencing, and often note that they get little support from government agencies when it comes to maintaining cleared vegetation gaps on both sides of a fence which exacerbates the cost issue.

While compiling the first edition of the wallaby fencing planning guide, it became clear that dealing with wombats and other wildlife entering via roads and tracks through fence lines were key unresolved problems for many landholders who had erected wallaby proof fencing. The Program funded research into both these areas with the findings of both these projects included in the second edition of the planning guide.

Another major project funded under the Program examined the behavioural response of both species of wallabies to fencing and shooting control strategies in the north east of the State. This study, which included the direct tracking of wildlife movements at night using GPS collars, indicated that following shooting events, the remaining population appeared to take advantage of the reduced competition and increased pasture availability by spending more time in the pasture areas feeding, which would obviously work against the effectiveness of this control method. By contrast, the wildlife monitored after a new fence was constructed either quickly found their way around the ends of the fence or just as quickly moved off into other areas to feed, either in the bush or in adjacent paddocks. Furthermore this trial, and subsequent video monitoring at another trial site near Waterhouse, both seemed to indicate that wildlife would only search a short distance (typically less than 100m) along a fence to find a breach, tending to search repeatedly back and forth along a short section of fence-line, rather than continue along a fence looking for breach points. This observation, although preliminary, indicates that a fence does not necessarily need to completely encircle a property to be effective as a control option.

Some small trials were carried out to try and overcome the barriers to adoption of fencing in plantations, mainly looking at cheaper approaches to wallaby proof fencing including using plastic barrier mesh and a cheaper electrified mesh system[1]. The latter trials, conducted with ClipEx, showed some potential in this area, though further work still needs to be done before these poles might become a viable option.

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[1] Developed by a company called ClipEx which has designed a pole system that allows fences to be more quickly installed and then removed.

The effectiveness of fencing was also evaluated in several of the pasture monitoring trials undertaken by TIAR. These trials identified significant differences in the effectiveness of wallaby-proof fencing at different study sites based on measured pasture loss within and outside of such fences.

Where wallaby-proof fencing was poorly installed and/or maintained, pasture loss within fenced areas could approach 90% of total pasture production. In comparison, Norton and Johannsohn (2010) reported that well installed and maintained wallaby-proof fences on King Island reduced pasture loss to around 25% of total pasture production. This finding is clear evidence that wallaby-proof fences need to be carefully installed and maintained if they are to be effective in controlling pasture loss to wildlife browsing.

SUMMARY

Much of the knowledge and research generated by the program in this area was underpinned by years of knowledge and trials undertaken by landholders in Tasmania over the past two decades.

The Program has identified that where wallabies are the main browser and where wallaby proof fencing can be cost effectively implemented in conjunction with best practice methods of wildlife population control , it is likely to be the most effective long term control strategy for reducing browsing damage.

Wallaby proof fencing is however not the solution by itself, and is limited in its use for browsing damage control in Tasmania. On many properties in Tasmania fencing will not be appropriate for the site nor will it be cost effective, and the cost and need to maintain fences is critical and often overlooked.

5.2 Seedling Stockings

Seedling stockings are essentially a low cost tree guard (Figure 11) made of a flexible netting similar to the material used in packaging oranges or onions and are placed on seedlings in the nursery before planting. They have become increasingly and widely used by the forest industry over the last five years, but very little research had been done into their effectiveness at reducing browsing damage.

Figure 11: Eucalypt seedling in a stocking.

The Program funded several research projects to evaluate and improve our knowledge of the effectiveness of seedling stockings.

Based on her trials field-testing promising non-lethal alternatives for browsing control, Dr Miller of the CRC for Forestry demonstrated that stockings, both by themselves and when used in conjunction with the Sen-Tree repellent, are effective at delaying browsing damage. However 12 months after planting, any difference in the growth of protected seedlings was statistically insignificant from the unprotected seedlings.

A separate trial by Dr Statham's TIAR team at Exeter also recorded an initial benefit from seedling stockings, but noted an increase in the browsing of seedlings with stockings towards the end of the trial (90 days), which appears to match what was being seen in Dr Millers trials.

These results could be explained by a combination of repeat browsing of the seedlings as they emerged from the stocking which removed the initial protection benefits provided by the stockings as was directly observed during a small video monitoring trial undertaken by Dr Edwards. Combined with reduced overall browsing pressure on plantations as the effectiveness of shooting or trapping efforts reduced the overall browsing pressure allowed the control seedlings to recover and catch up to the seedlings protected by stockings.

A follow up trial, undertaken by TIAR and funded by the Program, examined the importance of stocking placement on seedling survival and observed whether longer 60cm stockings supported by a bamboo pole might be more effective as they could allow seedlings to grow above browsing height before emerging from the stocking.

This 12 month trial found that the seedlings in stockings were significantly taller than those planted without stockings, and that issues such as stockings that were closed at the top, seedlings planted too deeply, or seedlings with stockings that were up to 20cm above the top of the seedling and hence 'flopped over' all had no significant impact on the seedlings height at twelve months of age. The seedlings that were planted with bamboo stakes and extra long stockings (60cm) often became entangled in the stocking and were statistically shorter than the other seedlings planted in shorter stockings.

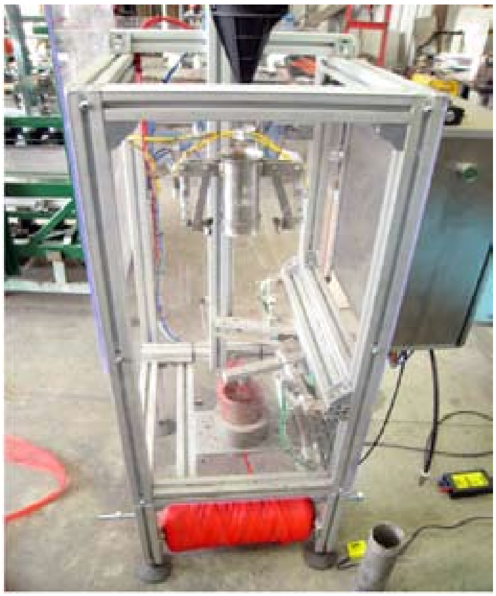

Figure 12: The first prototype for an automated stocking machine.

Forest management organisations often mentioned cost as a key impediment to seedling stocking application, and following further consultation on funding priorities with this stakeholder group in 2009, the Program funded the development of an automated stocking machine that could be linked in with either automatic or manual seedling production systems used in the State with the aim of reducing the cost of stocking application by 50–70% and thus increasing the use of seedling stockings by forest management organisations.

The first prototype of this machine for use in nurseries was demonstrated at the Alternatives to 1080 April 2010 workshop, and very positive feedback was received from stakeholders that saw the machine and observed it in practice. However, with the collapse of the MIS investment schemes, and the current financial crisis within the plantation forest industry, the focus has been on cost cutting, and nurseries have yet to adopt these machines.

SUMMARY

As seedling stockings are now widely used by all forest management organisations, there is little more that needs to be done to improve their adoption.

The greatest potential research in this area would be the development of taller, easily applied, yet inexpensive, stockings that could allow seedlings to grow beyond browsing height. Without this, stockings will always have an important but limited use in control strategies as eventually seedlings will emerge from the stockings and there will be a time period between emergence and growth above browsing height creating an opportunity for wildlife browsing.

Other niche research areas such as continued work into the development of integrating repellents into seedling stocking mesh, identification of biodegradable stockings, and research into trying to make stockings less attractive to deer (eg. through colour choice or repellent impregnation) may be worth pursuing in the future.

The greatest practical application in this area would be the adoption of the automated stocking machine in a cost effective manner by forest management organisations.

5.3 Deterrents and Repellents

Deterrents and repellents have been advocated as browsing management tools for well over a century due to their attractiveness as a non lethal control tool. However it is telling that forest management organisations prefer barrier controls such as seedling stockings to repellents.

The Program initially looked at several single agent repellents based on predator odours, specifically tiger faeces and dingo urine, and two small trials on the efficacy of dingo urine were conducted in conjunction with Dr Parsons of Curtin University. Funding was also offered to the University of Queensland to undertake trials into evaluating the effectiveness of tiger faeces, as a deterrent for Tasmanian browsing wildlife, but the university declined the funding offer due to other research priorities they had with this product.

The initial trial involving dingo urine indicated that pademelons, and to a lesser extent possums, did have at least a short term aversion to the product, though video monitoring showed a highly variable response between individuals. Furthermore, despite being replenished daily, the effectiveness of the product also appeared to weaken in the short period of the trial (two nights).

The results were positive enough that dingo urine was included in a second comparative trial undertaken by an honours project comparing Feralmone®, dingo urine and a multi-agent repellent developed by the New Zealand research and development company, Connovation, through funding by the Program.

The multi-agent repellent project was funded following an Alternatives to 1080 Program workshop in 2007 into repellents where it was agreed that the best short term opportunities for finding an effective repellent lay in moving away from a focus on comparative testing of single active ingredients and products to a focus on developing a contact repellent combining the best of existing 'actives' into a single formulation that would work through several different mechanisms including smell, taste, grittiness and fear.

The comparative study of these three products demonstrated that the multi-agent repellent was the most effective over the two weeks of the trial. However the product was reported to be so offensive to handle that further field trials were abandoned.

Parallel to this work, Dr Miller's work into manipulating seedling palatability was showing that Sen-Tree®, a wallaby repellent specially designed for protecting seedlings, when used in conjunction with seedling stockings was more effective at delaying browsing damage than if either tool was used alone.

Independent of all of this forest management organisations were reporting issues with fallow deer pulling seedling stockings out of the ground at a number of sites within the deer range.

This confluence of events, lead to a final round of funding into repellents in 2009, where Connovation were successful in obtaining further funding to look at the development of a seedling stocking that could carry a repellent and release it over time.

To gain maximum benefit from this trial, Epro, a New Zealand pest management company which had developed a deer repellent that was used with 1080 poison baits to stop by-kill of deer, was invited to participate in the 'Smelly Stocking' project and their repellent was used for the trial.

Figure 13: Seedling and stocking coated with EPRO's deer repellent.

This project showed some early promise, but was compromised by Program deadlines forcing trials to be undertaken in summer, leading to a large loss of seedlings due to dry conditions, and also final reporting deadlines which did not allow the full investigation of the potential of either this repellent or the new seedling stocking materials developed by Connovation.

Another strand of Dr Miller's work indicated that there may be some potential in the selection of genetically less palatable seedling stock, but further work would be needed to prove this as a viable option.

The Project Officer program undertaken within DPIPWE also undertook a number of smaller investigations into 'novel' deterrent ideas such as water powered jets, automated sentry paintball guns, flashing spotlights, recorded gun shots and bio-acoustic sounds. Some of these progressed to a trial stage, but whilst these tools may be effective in domestic gardens protecting a few plants, none looked to provide potential to deter wildlife browsing at the larger scale required for protecting crops, pastures or plantations.

SUMMARY

Overall, research and trial work conducted by the Program into deterrents and repellents suggests that wallabies and pademelons, which are cautious feeders, were more easily deterred from browsing by repellents than brushtail possums, and any future research could focus on single species repellents combined with other controls for non targeted species.

Further research into seedling genetics may identify potential for developing unpalatable seedlings.

5.4 Shooting

Shooting is by far the most commonly used method of browsing damage management currently undertaken in Tasmania, and its use has significantly increased commensurate with the decrease in 1080 poison use across the State. Returns provided to DPIPWE by holders of crop protection permits indicate that three quarters of browsing wildlife shot for crop protection purposes are done so under permits issued to the farming sector, and the remaining quarter under permits issued to the forestry sector.

Figure 14: An ATV set up for shooting.

Given its importance as a control tool, much of the Program's research effort went into evaluating shooting effectiveness in reducing wildlife browsing impacts and looking at ways of improving its effectiveness.

The Program funded a number of trials into the use of specialised equipment like firearm sound suppressors (silencers), infra-red scopes and thermal imaging scopes to see if they could be used to improve shooting as an alternative to 1080 poison.

These trials demonstrated that each of these tools could improve the effectiveness of shooting as a control effort in the right circumstances; however all of the tools had limitations.

The trials found that a firearm silencer, in combination with appropriate sub-sonic ammunition, can increase the effectiveness of shooting in achieving crop protection against smaller forms of wildlife, including Tasmanian pademelons and brushtail possums. However, use of subsonic ammunition reduces a firearm's effective range. If used inappropriately this can create animal welfare issues due to increased wounding risks. Infra-red scopes are expensive ($1,000 – $5,000) and are more suited to fixed position shooting of wildlife feeding on bait piles at known distances, as it is harder to accurately estimate distance to targets, and hence deliver accurate shots with these scopes when compared to normal scopes. This also increases their wounding potential. Thermal scopes demonstrated a huge potential for locating animals that would be missed with normal spotlights and hence increasing shooting effectiveness, but were also by far the most expensive option ($5,000 – $25,000) and were much less effective following hot days where rocks and stumps would also give off strong heat signatures.

There are no regulations prohibiting the use of commercially available infra-red and thermal imaging scopes, though due to their cost they are only likely to be adopted by commercial operators. There are however restrictions under the Firearms Act 1996 on the possession and use of silencers in Tasmania, although this is currently under review by Tasmania Police using the information obtained under the Program.

Trials into shooting, including commercial harvesting, suggest that a lot of shooting effort currently undertaken for crop protection purposes is in fact not achieving this objective. Trials on King Island showed that commercial harvesting, in isolation, of high density populations had no benefit for pasture protection, and even intensive shooting was only effective if the landholder was able to sustain an ongoing shooting effort to maintain low population levels after the initial control knockdown effort. This appears to have only been achieved on one site in this trial.

Work undertaken by the Program's project officers indicated that the landholder's perception of their browsing damage problem and their ability to control it did not always match the reality of the situation. An example of this was a trial site where the landowner had reported that he had four recreational hunters shooting on his property, plus two family members who also went out shooting, but that he believed it was now impossible to control the wildlife damage by shooting. Crop protection returns from this property showed the combined cull of these six shooters was between 150-200 wallabies per year. After conducting a trapping trial on the site which removed 134 animals in just 10 nights of trapping, one of the Program's project officers went on to cull 193 wallabies on the same property in just two nights of shooting which is more than the six recreational shooters were reporting for the entire year.

This result was not atypical, and leads back to the conundrum of landholders knowledge, capacity and motivation in undertaking effective control not matching what is required to achieve that control.

Supporting this, an analysis of a sample of recreational hunters shooting logs from 2009 found that 44% of trips shot two or less wallabies per hour, 79% of trips shot less than six wallabies per hour and 94% shot less than 12 per hour. In contrast, a review of control efforts undertaken by the Program's project officers and other professional shooters over the life of the program showed that their average take was between 20-30 wallabies per hour across all sites and projects.

Trials were also carried out under the Project Officer program undertaken by DPIPWE to evaluate the phenomenon of 'gun shyness' of animals. These trials were able to utilise infra-red and thermal monitoring equipment, not previously used in Tasmania, to directly monitor animal responses to stimuli such as gun shots, spotlights and vehicle noises. These trials clearly showed a learned avoidance behaviour by animals to stimuli such as vehicle noise, and when counts using both normal spotlighting and thermal imaging techniques were conducted together this clearly demonstrated the large number of animals not detected by normal spotlighting techniques because of vehicle avoidance behaviour by animals.

Figure 15 and 16: The left photo shows the paddock by day and the right by night. Using thermal imaging each small dot represents a wallaby, the larger images are cows.

The research into shooting effectiveness by Dr Natasha Wiggins, which included the direct monitoring of GPS collared wallabies before and after shooting events, indicated that the remaining wallabies spent more time on pasture areas after the shooting event than before which would indicate that the benefits in removing wallabies will be offset by the remaining population, at least up to a certain point.

SUMMARY

Putting all of this research together has led to the simple but important conclusion that the right shooting operator, with the right tools and the correct approach can significantly reduce local population numbers, and browsing damage, in the short term and maintain this reduction. The trials also clearly indicated that the wrong approach can increase the problem by making animals gun-shy. The problem appears to be that this level of effort is both expensive and labour and time intensive and most farmers are not able or prepared to sustain these efforts year after year whilst still doing their principal job of running the farm. Based on the research, it is not possible to be definitive as to whether this level of effort will satisfactorily reduce pasture losses to wildlife to acceptable levels and if so whether it will be cost effective.

5.5 Trapping

Due to Forestry Tasmania's use of the Mersey Box Trap as a key element of its phase out of 1080 poison use in 2005, trapping was seen as a very promising alternative to 1080 poison use across the State and significant effort and trials went into evaluating the use of trapping with humane destruction by shooting as an alternative to 1080 poison.

The development of traps for Bennett's wallabies was a focus area for the Program, and many different designs were trialled. However Bennett's wallabies appear to be much more cautious in entering traps or enclosed areas than pademelons, and the trade offs in trap size, cost and usability have to date prevented the development of a Bennett's wallaby trap that would meet animal welfare requirements.

Figure 17: A set Mersey Box.

Dr Tim Wardlaw of Forestry Tasmania led an early research project looking at using traps to target the removal of brushtail possums in plantations, but this and subsequent browsing monitoring trials have confirmed that wallabies still cause significant browsing damage, and hence a multi-species approach to browsing management is required in plantations.

Figure 18: A set Stubby Trap.

Dr Ivo Edwards, the developer of the Edwards Tent trap, was provided with funding to look at several aspects of trap design and trapping approaches, and this work has lead to further improvements in trap design for pademelons and helped him refine his trap designs and trapping strategies. The most concrete outcome from his trials has been the development and registration of his 'Stubby 2' design traps, which are a smaller, cheaper, simpler trap that he has demonstrated to be effective in capturing both brushtail possums and pademelons. Dr Edwards work has also significantly contributed towards an understanding of animal welfare issues, animal behaviour in traps and alternative trapping strategies on farms.

In an effort to improve the effectiveness of trapping, both Dr Edwards and the Project Officer Program undertook a number of trials over the life of the Program looking at variables such as pre-feeding times, use of different baits and attractants and comparisons of the different trap designs on animal capture rates. These trials confirmed that pre-feeding improved trapping capture rates due to pademelon's initial wariness of traps, and that there was little to separate the different grain, carrot and attractant mixes commonly used for trapping. These trials also showed that trapping is probably best done in conjunction with other control tools, such as shooting, and that there is high nightly variability in trapping success. This is particularly problematic with trapping, because unlike shooting where if it is a quiet night you can just go home, with trapping you still need to set and bait all the traps the day before and then come back and check and unset every trap the next morning. To undertake all this effort to only capture five animals in fifty traps can be quite disheartening.

There are some other real limitations to trapping. A large trial carried out by the Project Officers in the north east of the State found that the most cost effective pademelon trapping strategy requires trapping density of around 50 traps per km of bushline. As Mersey Box Traps cost around $200 per trap, it would cost around $10,000 to purchase the required number of traps. Considering that a kilometre of fully erected wallaby proof fencing costs about the same as 50 traps, and with a good shooter usually able to shoot 20 to 50 wallabies in 2-3 hours of shooting (cost approx $100 – $300) there are real financial barriers to widespread adoption of trapping as an alternative to 1080 poison. The other main impediments to trapping are the vulnerability of traps to theft and damage, particularly by wombats, the time intensive nature of trapping and their ineffectiveness against Bennett's wallaby.

Despite these limitations, extension and demonstration activities with landholders around the State have shown that there is a niche for trapping as a control tool, with very positive feedback from those landholders who were lent traps from the Program. However, follow up inquiries conducted by the Program indicates that none of these landholders have gone out and purchased their own traps to continue the effort.

Dr Edwards is further evaluating control strategies where, rather than purchase traps, landholders instead maintain inexpensive feed stations around the boundary of their properties at easily accessible locations (travel time is the major cost component of trapping programs after the initial capital cost) and then lease traps or trapping services for short periods of time to trap out these areas on a regular basis. It is still uncertain whether there is a market for this type of service, though Dr Edwards approach of using monitoring to quantify animal densities pre and post trapping to demonstrate effectiveness is a potentially useful approach.

Trapping also has specific welfare risks with wildlife being constrained overnight leading to trapping scoring a lower welfare ranking than shooting. There is also the potential that operators may not check traps everyday, or that people will begin building their own traps, which may not comply with animal welfare requirements. These could be significant welfare issues, suggesting that there are some regulatory and enforcement issues that will likely need to be considered if trapping becomes a more widely used tool across the Tasmanian landscape.

SUMMARY

Trapping is limited to smaller browsing wildlife, pademelons and possums, and is unlikely to become a widespread alternative to 1080 poison until the cost benefit relationship significantly changes, but it may become an important niche for landholders who are tired of shooting at night, have smaller properties, neighbour issues, difficult areas to shoot etc. or if better more effective strategies can be developed.

5.6 Feratox®

Feratox®, an encapsulated cyanide based poison widely used for brushtail possum control in New Zealand, was identified as a potential replacement for 1080 poison at the beginning of the Program because it appeared to address all of the main animal welfare concerns associated with 1080 poison.

Whilst sensitive to the concerns of bringing a new poison into Tasmania, given the apparent animal welfare benefits of Feratox® over 1080 and the other positive aspects of Feratox® over 1080 poison identified in an independent review undertaken in 2006, the Implementation Committee of the Program agreed to a systematic program of social and scientific evaluation of the use of Feratox® as an alternative to 1080 poison in Tasmania.

The initial step in this process was to evaluate the likely social, regulatory and animal welfare hurdles to the adoption of Feratox®.

Whilst stakeholders had raised concern about the potential poisoning of Feratox in Tasmania, a review of its use in New Zealand demonstrated that within the right regulatory framework, Feratox® can be safe to use and poses a negligible risk to the wider community.

In order to gauge the level of social acceptance to the use of Feratox in New Zealand, a review of all New Zealand newspaper articles, letters etc. on either 1080 poison, Feratox® or Cyanide over the previous five years was undertaken by the Program Manager. This review clearly showed that whilst 1080 poison use in New Zealand was extremely divisive within the community during the review period, the use of Feratox® raised very little media discussion and the tone of the articles that mentioned Feratox® suggested a broad acceptance of its use.

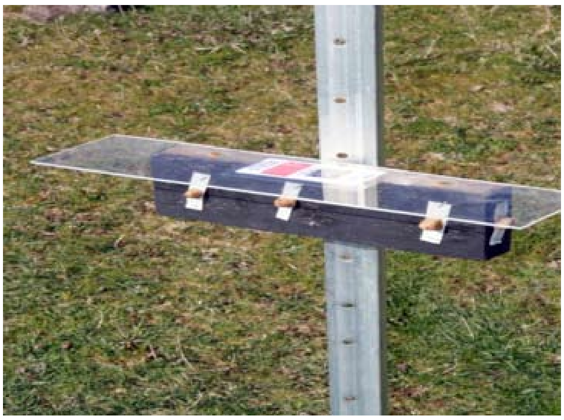

Figure 19: Feratox bait station developed for trials in Tasmania.

Specific discussions were also held with scientists from the Australian RSPCA to ascertain their views on whether it was appropriate to carry out research in this area, and with the Australian Pesticides and Veterinary Medicines Authority (APVMA) regarding the registration process for the use of Feratox® for use against brushtail possums and wallabies in Tasmania.

Finally, focus group discussions were held with stakeholder groups across Tasmania. These forums indicated an attitude best summarised as 'Now I know about it, I think it's a good idea, but will everyone else accept it?'. Tasmanians generally have an ingrained belief that 1080 poison is a cruel poison, and even landholders who would be happy to use Feratox® have concerns that the 1080 poison stigma may carry across to Feratox® making it socially unacceptable.

Following the outcomes of this initial stage, a series of staged pen and field trials were funded by the field trials were funded by the Program to test the efficacy and humaneness of Feratox® on wallabies, and to seek to address issues with species specific targeted delivery of Feratox®. Feratox®, unlike 1080 poison, is not species specific, and therefore delivery mechanisms have to be developed to ensure this species specificity.

SUMMARY

As at the end of the Program, several of the major issues which limited the use of 1080 as an animal control toxin in Tasmania have been resolved for use of Feratox®. Ongoing work being undertaken in New Zealand, where Feratox® has now been registered for wallabies, is addressing bait spillage issues. Bait spillage is of particular concern in Tasmania as spilled bait is potentially available for eating by non-target wildlife.

From a technical perspective, Feratox® satisfies most requirements when it comes to an effective control tool, and within an appropriate regulatory framework it could be made available alongside shooting, trapping and fencing as a frontline control tool allowing the complete phase out of 1080 poison in Tasmania whilst at the same time giving land managers another effective crop protection option.

Registration would however be a time consuming and costly process, and so is unlikely to proceed unless support for its use is demonstrated by stakeholders.

5.7 Fertility Control

Although identified as part of the *Strategic Plan*, no direct work on fertility control was funded by the Program primarily because no research area was identified which offered reasonable chances of developing effective control alternatives.

Ignoring all of the technical problems with the development and delivery of a fertility control tool for multiple species, there is still the fundamental problem that even if animals are made infertile, these animals will still continue to cause the same levels of crop damage as long as they are alive.

SUMMARY

Based on current knowledge, fertility control is not a viable alternative to 1080 poison for reducing damage from wildlife in Tasmania.

6. COMPARISONS WITH 1080 POISON

The median financial cost to landholders of their last 1080 poison baiting operation (calculated in the RDS study for landholders who had used 1080 somewhere between 2004 and 2007) was $1,405. Many of these (pre July 2006) would not have included the costs or time of the independent assessor process, which would add $300 – $500 to each poison baiting operation.

By contrast, the median financial cost reported for shooting was $3,225 per year, however the range was wide, and the largest portion of the cost was made up of hours spent shooting, which often isn't perceived as a direct cost to the landholder as it is either their own time or that of unpaid recreational shooters. The median time spent shooting was 82 hours per year.

Monitoring of several 1080 poison baiting operations by the Programs Project Officers has produced similar numbers to the RDS study, and financial modelling undertaken by the Program, has produced results confirming that a well executed 1080 poison baiting operation will normally be the most cost effective once off knockdown control tool available. Trapping, will normally be the most expensive knock down option, and fencing should not be considered as a knock down control tool due to the animal welfare and browsing issues on the other side of the fence associated with excluding a population from its normal food source. Fencing does however offer long-term control of browsing damage that will to some extent offset the higher cost.

Shooting, at its best, can be more effective than a 1080 poison baiting operation, which may seem paradoxical given that it is a requirement before doing a 1080 poison that a minimum level of shooting be undertaken. However as noted in the shooting section of this report not all shooting is equal, and it is quite possible that a good wildlife controller can do more in one nights shooting, than an average landholder can do in several nights, or even a year. At one trial at a property at Turner's Marsh, a single wildlife controller with a spotter using a thermal imaging scope was able to cull 304 animals from an 80 hectare property in two nights shooting, and post shooting counts indicated that this had been more effective in reducing numbers across the property than a 1080 poison baiting operation carried out there four months earlier. Both options cost about the same in out of pocket expenses, but the landholder made significant time savings using the shooting option.

However as the RDS study of landholder perceptions identified, the primary reason 1080 poison use is declining is that landholders already consider that 1080 poison is too hard to get and too expensive to use, which would by default suggest that the other control options like commercial shooters and trapping will also be considered too expensive.

The conundrum inherent in this study of landholder perceptions is that financial modelling of the benefits of reducing wildlife losses indicates that the benefits of undertaking effective control will generally outweigh the costs for properties experiencing high levels of wildlife damage, and that even wildlife fencing, which is considered to be the most expensive control option, will often pay for itself in a few years, assuming the fence is well built, and effectively maintained.

This is not easily unravelled, but the root of the problem may be that many landholders underestimate the cost of wildlife browsing and further question why they have to bear the costs of managing the community's wildlife that are coming onto their properties. When combined with the high cost of an effective control strategy and uncertainty of how to approach control management, this results in the landholders just doing what they've always done, whilst hoping for the development of a new 'silver bullet' solution to the problem.

SUMMARY

When comparing other control options to 1080 baiting as a once off knock down tool it is apparent that 1080 poison is still the most cost effective tool available, although shooting at its best can rival it.

However, when looked at as a strategic or ongoing program, where significant production losses are being experienced, an integrated strategy using a variety of control options is likely to be cost effective for the landholder.

The issue that appears to need addressing is that the cost and level of effort required to implement an effective alternative browsing control strategy is both expensive and time intensive and most landholders aren't willing or able to fund the up-front costs of implementing strategies, particularly fencing strategies, or prepared to sustain the level of effort required year after year whilst still doing their principal job of 'running the farm', especially when the benefits of implementing these controls is perceived as being uncertain.

DISCUSSION AND SUMMARY

When the Tasmanian Community Forest Agreement (TCFA) was signed in May 2005, 8.1kg of 1080 poison was being used across 155 farming properties and 279 forestry coupes (2004-05) in Tasmania.

By 2009-10, use of 1080 poison had declined by 91% to 0.74kg with just 11 farming properties (43% of usage) and 33 private forestry plantations (57% of usage) using 1080 poison. In the first six months of the current financial year (2010-11), 22 farming properties have used 1080 poison, and no forest plantations have used 1080 poison.

This huge decrease has been largely due to regulatory changes to the *code of practice for 1080 use* driving down usage in the farming sector, the decision by the Tasmanian Government to end the use of 1080 poison use by Forestry Tasmania in December 2005, and the decisions by private forestry companies to voluntarily cease using 1080 poison as they have become more confident in the other alternatives available to them.

In practical terms, during the life of the Program the farming sector has largely abandoned the use of 1080 poison other than in the most extreme browsing situations, and the private forestry sector, which five years ago poisoned 70-80% of new plantations, has now effectively stopped using 1080 poison altogether.

However, whilst 1080 poison usage has plummeted, farmers and foresters continue to report that losses from wildlife browsing are significant, and often report that losses are increasing.

These statements are supported by

- The annual spotlight counts undertaken by DPIPWE which continue to show relatively high population levels of the three major browsing mammal species across the State;
- Monitoring work undertaken by the Program which has clearly shown very significant crop and pasture losses even where landholders are undertaking control work; and
- DPIPWE culling figures from crop protection permits that indicate that the number of wallabies and possums being shot has increased significantly in response to the decrease in 1080 poison usage.

Management of wildlife to reduce production losses in Tasmania today is arguably not so much about continuing to reduce the use of 1080 poison, as current usage is probably as low as it will go unless a political decision is made to further restrict its use by policy change. Rather the issue is the underlying problem of how landholders, particularly farmers, can deal with the large production losses being experienced as a result of wildlife browsing now and into the future.

The aim of the Program was to accelerate research into, and implementation of, alternative control strategies for damage caused by native wildlife on private forests and agricultural land, which do not require the use of 1080 poison.

The Program has advanced our understanding of alternative control options on many fronts from improved understanding of the potential for specialised shooting equipment such as thermal scopes and silencers, new trap designs and trapping approaches, developments to improve the cost effectiveness of seedling stockings, evaluation of several potential repellents, improvements in wildlife fencing such as wombat gates and wallaby grids and an alternative and potentially more acceptable poison, Feratox®.

The Program has also shown that shooting, trapping and fencing can all be effective in reducing browsing damage if implemented well, though they will usually be more costly and time consuming than a well executed program that includes 1080 poison.

More importantly the Program has highlighted the extent of production losses in agricultural areas from wildlife browsing and has shown that to be effective at reducing crop or pasture losses, any control strategy must effectively reduce and maintain local wildlife numbers at very low levels over time, and must target those areas where the highest levels of damage are being experienced.

The evidence to hand is that much of the control effort in Tasmania is not achieving this objective, and in fact it even suggests that any control strategy that relies on just one control tool is unlikely to be effective due to the diminishing effectiveness of most control options at lower population densities or in the case of fencing, its diminishing effectiveness at higher population levels.

Where ongoing control is needed, the most effective control strategies are likely to be those which use a combination of controls, and particularly those that use effective pasture or crop monitoring techniques and integrate effective wallaby proof fencing with best practice shooting, trapping or poisoning.

Wallaby proof fencing is not a solution by itself, and does have limitations to its use for browsing damage control in Tasmania. On many properties in Tasmania fencing will not be appropriate or cost effective due to site factors. Because of this, the more control options that are available to landholders the more likely they will be able to implement an effective control strategy.

This is one of the key reasons why Feratox® has been researched and examined in such detail.

One of the key outputs from the Program's research trials, extension and demonstration activities has been the development of a Wildlife Management planning toolkit which is scheduled for release at Agfest in May 2011. This toolkit consists of three main documents:

1. A planning guide workbook titled *Managing Losses due to Wildlife on Farms*. This publication is based on the principles of effective vertebrate pest management outlined in the Australian Bureau of Rural Sciences PestPlan Toolkit (2003), but customised towards the Tasmanian situation and based on the work carried out under the Alternatives to 1080 Program.
2. A Wildlife Management Strategy Workbook. This has been designed for landholders to complete as they work through the Planning guide and in conjunction with the additional information resourced in the information booklet. Cross referencing between the Planning Guide and Wildlife Management Strategy Workbook occurs to make the process of developing a Wildlife Management Strategy for a particular property a process that landholders can do independently.

3. The Information Booklet is a compilation of 11 different documents combined into a single booklet for ease of management and document safe keeping. The information booklet has been designed to be supportive of both the Planning Guide and the Wildlife Management Strategy Workbook by providing landholders with additional information needed in the management of losses caused by browsing wildlife. Six of the eleven brochures contained within this booklet were first released by the Alternatives to 1080 Program at Agfest 2010. They have since been revised. These brochures focus on helping landholders understand how the different species will impact on a farm's productivity, which control options are effective in different situations, how to undertake effective monitoring, and also how to implement the currently available control options effectively.

This toolkit is an important first step in addressing the information void that currently exists on the alternatives to 1080 poison by providing a framework, and the necessary tools, that landholders can now use in implementing an effective browsing damage management strategy.

Importantly, whilst there may be areas that would benefit from further research work, with limited obvious new options apparent, the next most important step is to help landholders more effectively utilise the tools which are already available to them today, or potentially available in the next few years.

In addition the BITE© model was developed by TIAR through the Alternatives to 1080 Program. BITE© is a simple to use model designed to provide landholders, extension officers, and agri-consultants with a way to estimate economic impacts of wildlife pasture grazing without having to undertake lengthy and time consuming pasture monitoring. It is hoped that this tool will help landholders move away from inaccurate monitoring techniques such as spotlight counting, and move towards more effective monitoring techniques and control strategies.

It is apparent that there are some key information, resource and financial barriers to landholders adopting new and improved practices. This implies a focus on getting existing knowledge to farmers on how to more effectively use the tools they have available and overcoming the barriers to their adoption, which are primarily financial and time constraints.

FURTHER READING

Published Papers

Miller AM, O'Reilly-Wapstra JM, Potts B McArthur C. (2009) Non-lethal strategies to reduce browse damage in eucalypt plantations. Forest Ecol. Manag. 259,45-55.

Eason CT, Shapiro L, Adams P, Hix H, Cunningham C, MacMorran D, Statham M, Statham H. (2010) Advancing a humane alternative to sodium fluoroacetate (1080) for wildlife management – welfare and wallaby control. *Wildlife Research* (in press).

Wiggins NL, Williamson GJ, McCallum HI, McMahon CR, Bowman DMJS. (2010) Shifts in macropod home range in response to wildlife management interventions. *Wildlife Research* (in press)).

McMahon CR, Wiggins NL, French V, McCallum HI, Bowman DMJS. Capture myopathy in the Tasmanian pademelon *(Thylogale billardierii)* and Bennett's wallaby *(Macropus rufogriseus). Australian Veterinary Journal* (submitted).

Wiggins NL, Bowman DMJS. Macropod habitat use and response to management interventions in an agricultural-forest mosaic in north eastern Tasmania as inferred by scat surveys. *Wildlife Research* (submitted).

Scientific Conferences and Papers

Grant deed recipients were encouraged and helped with funding to attend scientific conferences. The following is a list of papers and posters presented at various conferences.

14th Australasian Vertebrate Pest Management Conference, Darwin in June 2008

Papers

- Mooney C, Fulton A. Understanding landholder decision-making about control of native browsing animals in Tasmania.
- Eason C *et al*. 1080 Alternatives for Tasmania (Humane Toxins).
- Edwards I. Advances in trapping for control of pest possums and wallabies in Tasmania as an economic alternative to 1080.

Posters

- Branson M. Your ass is grass! Investigating sustainable management of native herbivores on King Island, Bass Strait.
- Eason C *et al*. New approaches to developing humane toxins; our rationale, questions and answers.

- Statham M *et al.* 1080 Alternatives in Tasmania – baiting strategies.
- Wiggins N *et al*. Different possum populations show the same aversions for genetically resistant seedling stock.
- Wiggins N *et al.* Responses of red-bellied pademelon *(Thylogale billardierii)* and red-necked wallaby *(Macropus rufogriseus)* populations to lethal control,

33rd Annual conference of the Ecological Society of Australia, Sydney, December 2008

Papers

- Smith, R. Impacts and economics of wildlife browsing on Tasmanian pastures.
- Wiggins NL, McMahon CR, Bowman DMJS, McCallum HI. Home range movements of the red-bellied pademelon and red-necked wallaby populations in response to native wildlife control.

Australasian Wildlife Management Society, Napier, New Zealand, November 2009.

Paper

Wiggins NL, Bowman D, McCallum, H, McMahon C. Macropod home range movements in response to wildlife management strategies.

24th Vertebrate Pest Conference, Sacramento, California, February 2010

Papers

- Smith R. Impacts and economics of wildlife browsing on Tasmanian pastures.
- Statham H, Statham M, Dawson J. Alternatives to 1080 poison for control of native animals in Tasmania: A response to public concerns.
- Statham M, Eason C, Statham H, Shapiro L, MacMorran D. (2010) Feratox® as a humane control agent for wallabies in Tasmania.

In addition, Rowan Smith presented a seminar to staff and students at the University of Calgary, and Rowan, Helen Statham and Mick Statham presented talks to the staff of the United States department of Agriculture, National Wildlife Research Center in Fort Collins, Colorado.

Papers Submitted to the Program

Branson MJ. (2008) Nocturnal population estimates of Bennett's wallaby *(Macropus rufogriseus),* Tasmanian pademelon *(Thylogale billardierii)* and brushtail possum *(Trichosurus vulpecula)* in pasture on King Island, Tasmania. King Island Natural Resource Management Group, Currie.

Coleman JD, Pech RP, Warburton B, Forsyth DM. (2006) Review of Research into Alternatives to the use of 1080 for Management of Browsing Damage by Mammals in Tasmania. Landcare Research LC0506/144, Christchurch.

Dawson J. (2010) Project Officer Program Reports to the Alternatives to 1080 Program.

Eason C, Statham M, Hix S, Shapiro L, Statham H, MacMorran D. (2010) A review of the development of cyanide pellets (2007-2010) as a humane alternative to sodium fluoroacetate (1080) for wallaby and possum control: achievements and future plans. Prepared for Department of Primary Industries, Parks, Water and Environment (DPIPWE) Tasmania.

Eason CT, Statham M, Statham HL, Boot S, McIlroy J. (2007) Outcome Report: Humane herbivore control – October 2007 stakeholder meetings report to Department of Primary Industry and Water, Tasmania. Connovation Hobart.

Edwards I. (2008) Trapping Browsers as an Economic 1080 Poison Alternative – 2008 Interim Report.

Edwards I. (2009) 1080 Alternatives Wallaby Trapping Deed – Final Report, with appendices. DPIPWE, Hobart.

Edwards I. (2010) Night Vision Filming Deed Final Report. Final report to the Alternatives to 1080 Program. Hobart.

Fowles A. (2009) Feeding and Behavioural Response of Tasmanian Wallabies, Pademelons and Possums to Repellents. Honours Project, University of Tasmania.

Johannsohn N. (2010) Draft Cattle grid report, report to The Alternatives to 1080 Program, January 2010.

MacMorran D, Lorigan R, Pillowe A, Shapiro L, Tucker N, Aylett P, Hix S, Eason CT. (2009) Smelly stockings- Preliminary report on product development logic. Contract Report to Department of Primary Industries, Parks, Water and Environment, Tasmania 6 pp.

Miller AM, O'Reilly-Wapstra JM, Potts BM, McArthur C. (2009a) Manipulating seedling palatability for non-lethal browsing management. CRC for Forestry Technical Report 195. Hobart.

Mooney C. (2010) Pyengana Integrated Native Browsing Damage Management Plan, Rural Development Services Final Report to the Alternatives to 1080 Program, January 2010.

Mooney C, Fulton A. (2008) Understanding landholder decision making for the use, and/or non-use, of 1080. Rural Development Services, Final Report to the Alternatives to 1080 Program, August 2008.

Mooney C, Presnell J. (2008) Review of Existing Property-Based Wildlife Management Plans in north east Tasmania for the Sub-catchment Scale Integrated Wildlife Management Planning Module Project, Rural Development Services, Draft Report to the Alternatives to 1080 Program 31 October 2008.

Norton T, Johannsohn N. (2010) Implications of Browsing by Native Wildlife on Improved Pastures and Native Vegetation Communities on King Island, Tasmania, Final Report to the Alternatives to the use of 1080 Program, April 2010. Tasmanian Institute of Agricultural Research.

Norton T, Lacey M, Smith R, Statham M, Rawnsley R, Donaghy D, Gracie A, Burkitt L. (2010) The Nature and Implications of Browsing by Native Wildlife on Tasmanian Farms, Final Report to the Alternatives to the use of 1080 Program, April 2010. Tasmanian Institute of Agricultural Research.

Shapiro L, Fish R, Pillowe A, MacMorran D, Lorigan R, Dawson J, Eason C .(2010) Impregnation of repellents into seedling stockings to increase browsing management effectiveness, Connovation, Auckland.

Shapiro L, Hix S, MacMorran D, Aylett P, Eason C. (2008) Final Herbivore Repellent Report prepared for The Department of Primary Industries and Water, Hobart, Tasmania. Connovation, Auckland.

Statham M, Statham HL. (2008) Use of bait stations to minimise poisoning of non-target herbivore species in Tasmania. An Unpublished report to the Alternatives to 1080 Program. Tasmanian Institute of Agricultural Research, Launceston.

Statham M, Statham H. (2010) Wallaby proof fencing: A planning guide for Tasmanian primary producers. Second revised Edition, TIAR, Hobart. TIAR, Hobart.

Statham M, Statham HL. (2010) Feratox® poisoning trials conducted in Tasmania Report to the Alternatives to 1080 Program.

Statham M, Statham H, Dolbey B, Fish R. (2010) Eucalyptus nitens seedling browsing trials, Report to the Alternatives to the Use of 1080 Program, May 2010.

Tasmanian Plantation Management Services. (2009) An investigation and demonstration of the effectiveness of shooting techniques as an alternative to 1080. Final report to the Alternatives to 1080 Program. Hobart.

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